

Method of Test for  
**RESISTIVITY VALUES OF SOILS AND WATER**

DOTD Designation: TR 429-88

### Scope

1. This method describes the laboratory determination of electrical resistivity values of soil or water samples.

### Apparatus

2. (a) *Meter* - Suitable for laboratory analysis. The meter shall have two scales, the top scale calibrated to provide electrical resistance readings in ohms and the bottom scale calibrated to provide electrical resistivity readings in ohm - centimeters. See Figure 1.

(b) *Box* - For use with meter in accordance with Figure 2.

(c) *Miscellaneous tools* - Mixing pans and tools, metal straightedge, all free of rust or other deposits.

(d) *Balance* - Having 2 kg minimum capacity and sensitive to 1 gram.

(e) *Distilled water*.

(f) *Resistors* - 200 ohm, 1000 ohm and 2000 ohm with a 5% tolerance.

(g) *Graduated cylinder* - 100 ml capacity.

(h) *Moist room* - Capable of maintaining a temperature of  $73 \pm 3^{\circ}\text{F}$  at a minimum 95% relative humidity.

### Calibration of Meter

3. Calibrate the meter at least monthly and any time an instrument malfunction is suspected.

(a) Zero the meter by clamping the two leads together, depressing and holding the read button, and adjusting the zero adjust knob.

#### NOTE:

*Depressing the read and zero buttons simultaneously will zero the internal circuitry only. This method of zeroing will not detect a problem in the leads.*

(b) Connect the leads from the meter to the two ends of the 200 ohm resistor and read the resistance value on the top (ohm) scale.

(c) If the reading is within 10% of the rated resistance, the meter is functioning satisfactorily.

(d) If the reading is outside the 10% range check one or all of the following:

(1) Check the leads for poor connections and/or breaks.

(2) Check the battery and replace if defective.

(3) Check the resistor with another ohm meter and replace if defective.

(e) Repeat steps (a)-(d) above using the 1000 ohm resistor and then the 2000 ohm resistor.

#### NOTE:

*If a malfunction of the meter is established, return the meter to the Materials Laboratory for repair before continuing resistivity testing.*

### Sample

4. Samples for resistivity testing shall conform to the following:

(a) Water samples shall be of at least one quart in size, and stored in a watertight plastic container.

(b) Soil samples shall consist of at least 1300 grams of soil passing the No. 10 sieve prepared in accordance with DOTD Designation: TR 411, Method A.

### Procedure

5. (a) Thoroughly clean the box of all soil particles or other contaminants.

(1) Wash with tap water, rubbing lightly taking precautions not to scratch or damage the stainless steel electrodes.

(2) Rinse three times with distilled water.

(3) Fill the box with distilled water to its capacity.

(4) Zero the meter by clamping the two leads together, depressing and holding the read button and adjusting the zero adjust knob.

(5) Connect the leads to the terminals on the box.

(6) Depress and hold the read button. If the meter reads infinity on the top (ohm) scale, then the box is clean.

(7) If the distilled water in the box does not measure infinite resistance, continue to rinse the box with distilled water until it is thoroughly clean (indicated by an infinite resistance measurement).

(8) If unable to obtain an infinite resistance reading after repeated cleaning, the purity of the distilled water should be checked by submitting a sample to the Materials Laboratory for testing.

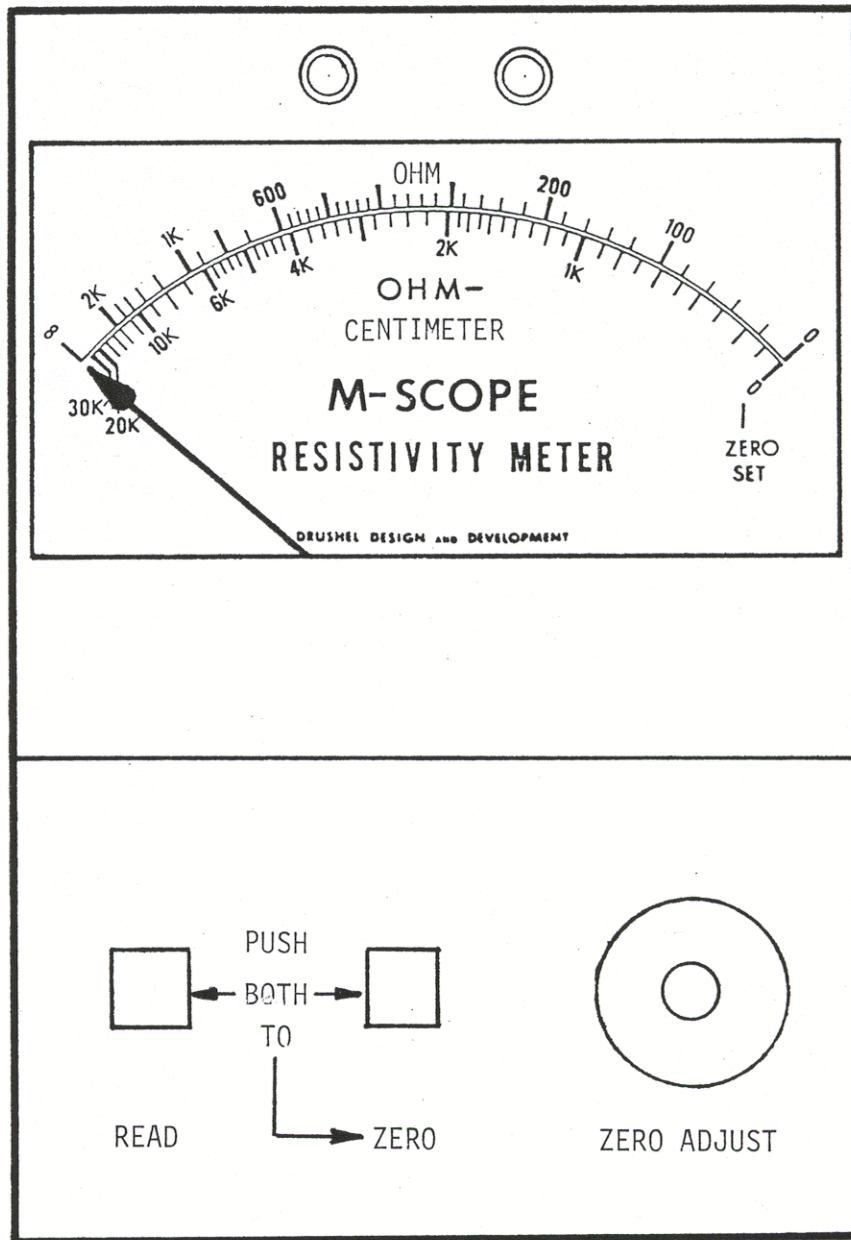
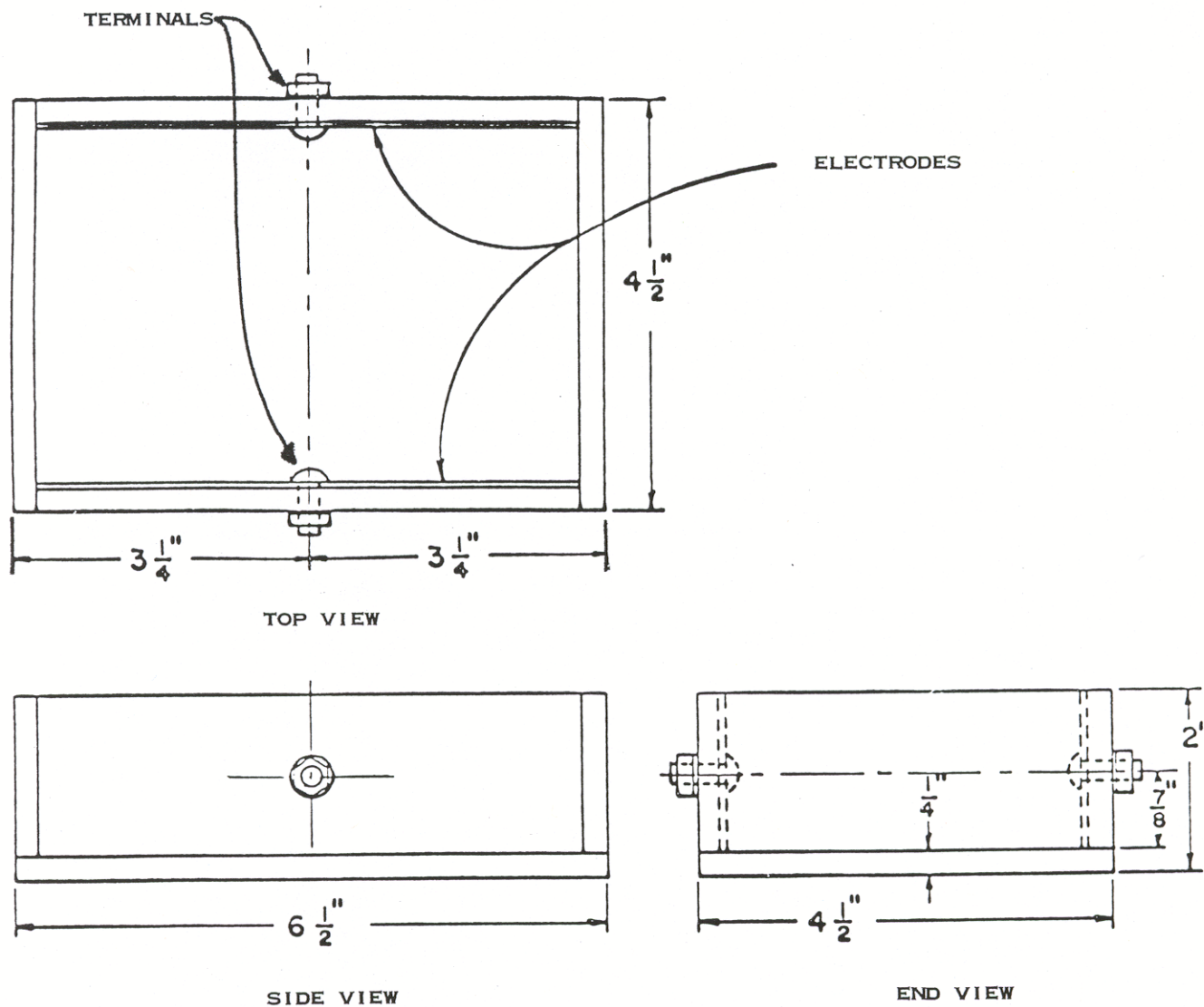


Figure 1

METER FOR LABORATORY RESISTIVITY DETERMINATION



NOTE: ALL JOINTS TO BE SEALED  
WITH WATERPROOF SEALANT

MATERIAL -  $\frac{1}{4}"$  PLASTIC

BOTTOM - 1 PC.  $6\frac{1}{2}" \times 4\frac{1}{2}" \times \frac{1}{4}"$

ENDS - 2 PCS.  $4\frac{1}{2}" \times 1\frac{3}{4}" \times \frac{1}{4}"$

SIDES - 2 PCS.  $6 \times 1\frac{3}{4}" \times \frac{1}{4}"$

ELECTRODES - 2 PCS. 20 GA. STAINLESS STEEL  $6" \times 1\frac{3}{4}"$

TERMINALS - 2 EA. NO. 8 - 32  $\times \frac{3}{4}"$  ROUND HEAD  
STAINLESS STEEL MACHINE SCREW WITH  
RUBBER WASHER & STAINLESS STEEL WASHER  
& NUT

FIGURE 2

BOX FOR LABORATORY RESISTIVITY DETERMINATION



(b) Resistivity of Water Samples

(1) Agitate the water sample vigorously.

(2) Pour the water sample into the clean box to its full capacity.

(3) Zero the meter as in step 3(a).

(4) Connect the two leads to the terminals on the box.

(5) Depress and hold the read button and read the resistivity value on the bottom (ohm-cm) scale of the meter to the nearest graduation. Record on the work card. (See Figure 3.)

(c) Resistivity of Soil Samples

(1) Add a sufficient amount of distilled water to the prepared soil to bring the soil to approximately its plastic limit. For non-plastic soils add 100 ml of distilled water.

Example: A soil sample has a dry weight of 1351 grams, and a plastic limit (PL) of 20 as determined in accordance with DOTD Designation: TR 428.

For the sample weighing 1351 grams, 20% moisture would be required to bring the sample to its approximate plastic limit (PL).

(2) Mix thoroughly and place in a moist room for a minimum of 12 hours.

(3) After removing the sample from the moist room, place and compact the soil sample into the clean box using moderate compaction with the fingers until slightly overfilled. Strike off the excess material with the straightedge.

(4) Zero the meter as in step 3(a).

(5) Connect the leads from the meter to the two terminals on the box. Depress and hold the read button and read the resistivity value on the bottom (ohm-cm) scale of the meter to the nearest graduation. Record on the work card. (See Figure 3.)

(6) Remove the soil from the box and combine with rest of the sample. Add 100 ml of distilled water to the sample and mix thoroughly.

(7) Clean the box as in step 5(a), refill and compact as in step (3) above.

(8) Repeat steps (4)-(7) above until two consecutive readings fail to decrease.

### Report

6. For water samples the resistivity value obtained in the above procedure shall be reported in ohm-centimeters. For soil samples the minimum value obtained in the above procedure shall be reported as the resistivity of the soil, also in ohm-centimeters.

Normal testing time is 2 days.



# RESISTIVITY VALUES OF SOILS AND WATER

DOTD Designation: TR 429

Material Soil

Dry Wt. of Sample, g. 1351 LL 35 PI 15

Water Added For Slaking =  $\frac{\text{Dry Wt.} \times (\text{LL} - \text{PI})}{100} = \underline{270} \text{ ml}$

H <sub>2</sub> O Added (ml)	Meter Rdg. (OHM-CM)	H <sub>2</sub> O Added (ml)	Meter Rdg. (OHM-CM)
<u>Initial</u>	<u>30,000</u>	<u>600</u>	<u>4,200</u>
<u>100</u>	<u>12,000</u>	<u>700</u>	
<u>200</u>	<u>8,000</u>	<u>800</u>	
<u>300</u>	<u>4,800</u>	<u>900</u>	
<u>400</u>	<u>4,300</u>		
<u>500</u>	<u>4,200</u>		

Minimum Resistivity 4,200 OHM - CM

Tested By: B. Smith Date: 8/5/88

Checked By: NDH Date: 8/15/88

Lab. No. 22-999999

S.P. No. 999-99-99

Sta. No. 99 + 99

Location 99' Lt.  $\phi$

Depth 0' - 9'

Sample No. 9

Submitter J. Wintz

Intended Use

Remarks:

Figure 3